

What is claimed is:

1. A barrier stack comprising:
a first barrier layer; and
a second barrier layer, wherein the grain boundaries
5 of the first and second barrier layer are mismatched to
enhances the barrier properties of the barrier stack.
2. The barrier stack of claim 1 further comprises:
a capacitor having a dielectric layer disposed
10 between first and second electrodes; and
a plug electrically coupled to the first electrode,
wherein the barrier stack is disposed between the plug
and first electrode.
- 15 3. The barrier stack of claim 2 further comprises an
adhesion layer between the barrier stack and the plug.
4. The barrier stack of claim 1 further comprises:
a ferroelectric capacitor having a ferroelectric
20 layer disposed between first and second electrodes; and
a plug electrically coupled to the first electrode,
wherein the barrier stack is disposed between the plug
and first electrode.

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5. The barrier stack of claim 4 further comprises an adhesion layer between the barrier stack and plug.

6. The barrier stack of claim 1, 2, 3, 4, or 5 further comprises elements stuffing the grain boundaries of the first barrier layer, wherein the elements comprise a diameter greater than the grain boundaries of the first barrier layer.

7. The barrier stack of claim 6 further comprises elements stuffing the grain boundaries of the second barrier layer, wherein the elements comprise a diameter greater than the grain boundaries of the second barrier layer.

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8. The barrier stack of claim 7 further comprises a first oxide layer disposed on the surface of the first barrier layer.

9. The barrier stack of claim 7 further comprises a second oxide layer disposed on the surface of the second barrier layer.

10. The barrier stack of claim 7 wherein the elements comprise oxygen.

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11. The barrier stack of claim 10 further comprises a first oxide layer disposed on the surface of the first barrier layer.

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12. The barrier stack of claim 10 further comprises a second oxide layer disposed on the surface of the second barrier layer.

10 13. The barrier stack of claim 6 wherein the elements comprise oxygen.

14. The barrier stack of claim 13 further comprises a first oxide layer disposed on the surface of the first
15 barrier layer.

15. The barrier stack of claim 6 wherein the barrier layers comprise a material selected from the group of materials comprising Ir, Rh, Ru, Pd, or alloys thereof.

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16. The barrier stack of claim 15 wherein the first and second barrier layers comprise different materials

17. The barrier stack of claim 15 wherein the first and
25 second barrier layers comprise the same material.

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18. The barrier stack of claim 15 wherein the first and second barrier layers comprise Ir.

5 19. The barrier stack of claim 10 wherein the barrier layers comprise a material selected from the group of materials comprising Ir, Rh, Ru, Pd, or alloys thereof.

20. The barrier stack of claim 19 wherein the first and
10 second barrier layers comprise different materials

21. The barrier stack of claim 19 wherein the first and second barrier layers comprise the same material.

15 22. The barrier stack of claim 19 wherein the first and second barrier layers comprise Ir.

23. The barrier stack of claim 13 wherein the barrier layers comprise a material selected from the group of
20 materials comprising Ir, Rh, Ru, Pd, or alloys thereof.

24. The barrier stack of claim 23 wherein the first and second barrier layers comprise different materials.

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25. The barrier stack of claim 23 wherein the first and second barrier layers comprise the same material.

26. The barrier stack of claim 23 wherein the first and
5 second barrier layers comprise Ir.

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